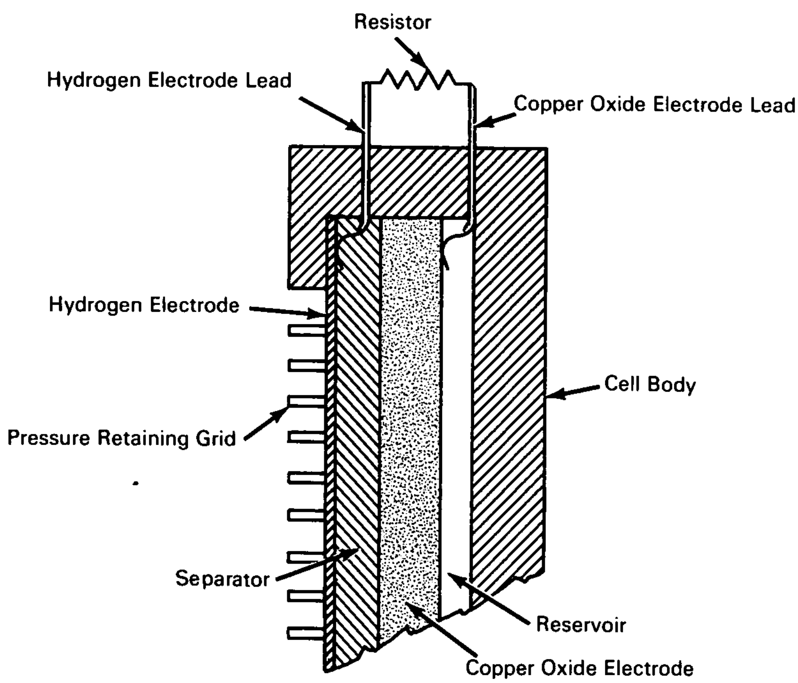
NASA TECH BRIEF

Device Removes Hydrogen Gas from Enclosed Spaces



The problem:

To design a device that will effectively remove small amounts of hydrogen gas continually released from equipment, such as vented silver-zinc batteries, in enclosed compartments where air venting is not feasible. Hydrogen accumulations may build up to levels sufficient to form explosive mixtures with the air in an enclosed compartment. Palladium black, which is one of the best absorbers of hydrogen at room temperature, would be expensive to use when relatively large amounts of hydrogen must be removed over extended periods.

The solution:

A hydrogen-oxidant galvanic cell.

How it's done:

The hydrogen electrode contains a platinum and palladium catalyst, or other catalyst system suitable for use with hydrogen. The electrolyte, held in the separator, is initially a 31 percent solution of potassium hydroxide in water, which is diluted during cell

(continued overleaf)

operation by the water formed by oxidation of the hydrogen. The oxidant electrode consists of a porous, sintered copper oxide which has been superficially reduced to metallic copper to serve as the current collector. The reservoir behind the copper oxide electrode serves to store the increased volume of electrolyte resulting from operation of the cell. This reservoir is initially filled with oxygen to block migration of electrolyte into this region during installation of the cell. The oxygen slowly diffuses into the front part of the cell where it can react either with the metallic copper or at the inner surface of the hydrogen electrode. This oxygen is eventually reduced to water, and in effect serves as an additional oxidant for removal of hydrogen. As the oxygen and hydrogen are consumed, the resulting increased volume of electrolyte passes through the porous copper oxide electrode to fill the reservoir. The cell is shorted by a resistor to dissipate the electrical energy produced.

Primary removal of hydrogen by oxidation to water occurs in accordance with the following cell reaction:

$$\text{Cell: } H_2(Pt)/KOH/CuO(Cu)$$

$$\text{Reaction: } H_2 + CuO \rightarrow Cu + H_2O$$

Notes:

1. Several other oxidant electrodes may be used in the cell. A copper oxide electrode was chosen because of its commercial availability and its low density.
2. Although these cells were designed for use in a satellite compartment, they may have application in other places, such as in enclosures for process equipment using or generating hydrogen, enclosures in which hydrogen tanks are stored, and in enclosures for emergency battery power supplies. The use of cells of this type in such applications would allow gastight enclosures to be used safely with a drastic reduction in ventilation requirements. For these applications, a rechargable electrode, such as the silver or nickel electrode, may be more suitable than a copper oxide electrode.
3. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Goddard Space Flight Center
   Greenbelt, Maryland 20771
   Reference: B66-10340

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: W. N. Carson
of General Electric Company
under contract to
Goddard Space Flight Center
(GSFC-495)